New Millennium EO3

Fuk K. Li
Jet Propulsion Laboratory
California Institute of Technology

The New Millennium Program (NMP) is a NASA technology program that focuses on the validation of advanced spacecraft and instrumentation technologies in space. This program specifically seeks technologies that could significantly benefit future space and Earth science missions by enabling new science capabilities and reducing life cycle costs. These technologies must also require a validation in space to mitigate risks to the first science users, and provide cross-cutting benefits to both NASA's Earth and Space Science enterprises.

The NASA Office of Earth Science (OES) directed the NMP to focus the third Earth Observing mission, EO3, on innovative measurement concepts that would facilitate remote sensing observations from orbits beyond conventional low-Earth orbit (LEO). These orbits include geosynchronous orbits, highly elliptical orbits, mid-Earth and high-Earth orbits, and other unique vantage points such as L1 and L2. To maximize the input from the Earth science community, a NASA Research Announcement (NRA) was released to solicit innovative measurement concepts for this NMP flight. Because the NMP is a technology validation program, rather than a conventional science program, the NRA required that these measurement concepts employ revolutionary technologies and/or measurement strategies that will enable future science missions from orbits beyond LEO. Another requirement was that a validation in space was needed to reduce real or perceived risks of this concept to future science users. The proposals submitted in response to this NRA were peer reviewed by the NASA OES. The measurement concepts selected through this process will be summarized in this presentation.

The EO3 measurement concept NRA did not solicit complete mission concepts or flight hardware. Instead, the selected investigators will join integrated project formulation teams to define the mission for the demonstration of the measurement technique and participate in mission design trades and implementation planning. The teams will define and document the measurement approach, the required technologies, the validation plan, the scalability of the design to future science missions, and the infusion path for the completely validated instrument. During this project formulation phase, the specific technologies required to implement each measurement concept will be solicited through an open technology solicitation, and the technology providers will be added to the integrated teams. Once a complete candidate mission concept has been formulated for each measurement concept, these concepts will be subjected to a comprehensive review. The Associate Administrator of the OES will use the results of this review to select a single concept for the EO3 flight opportunity. That mission concept will enter its implementation phase, which is expected to last for less than 36 months before launch. During this phase, and after launch, the implementation team will work with the NMP to document and disseminate the information gathered during the flight qualification testing and operations of the measurement concept and its component technologies. This

information will be archived and published, where appropriate, to encourage the rapid infusion of these validated technologies into future space and Earth science missions.

NEW MILLENNIUM PROGRAM

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Fuk Li

Jet Propulsion Laboratory
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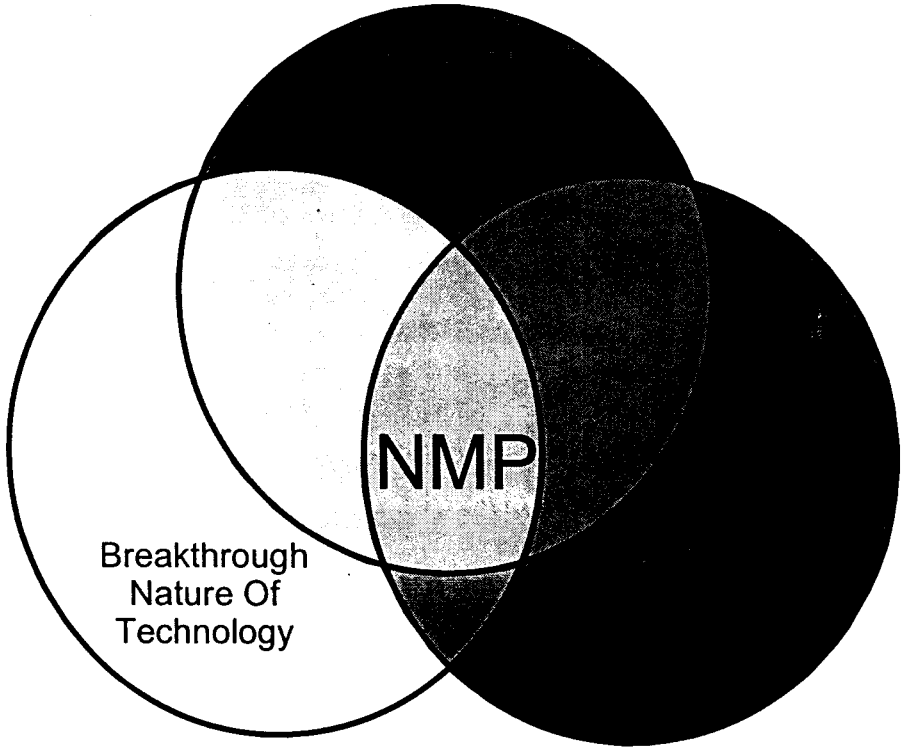
Overview

- Define New Millennium Program Objectives
- Summarize ongoing NMP Flights
- Describe validation objective for EO3
- Provide overview of NMP processes for
  - Measurement concept selection
  - Validation Flight formulation
  - Technology validation and infusion
- Summarize results of NRA
- Describe remaining steps in the project formulation and confirmation process

New Millennium Program Focus

Flight validate breakthrough technologies that will significantly benefit future Space Science and Earth Science missions



- Breakthrough technologies
  - Enable new capabilities to meet Earth and Space Science needs
  - Reduce costs of future missions
- Flight validation
  - mitigates risks to first users
  - enables rapid technology infusion into future missions

NMP Objectives

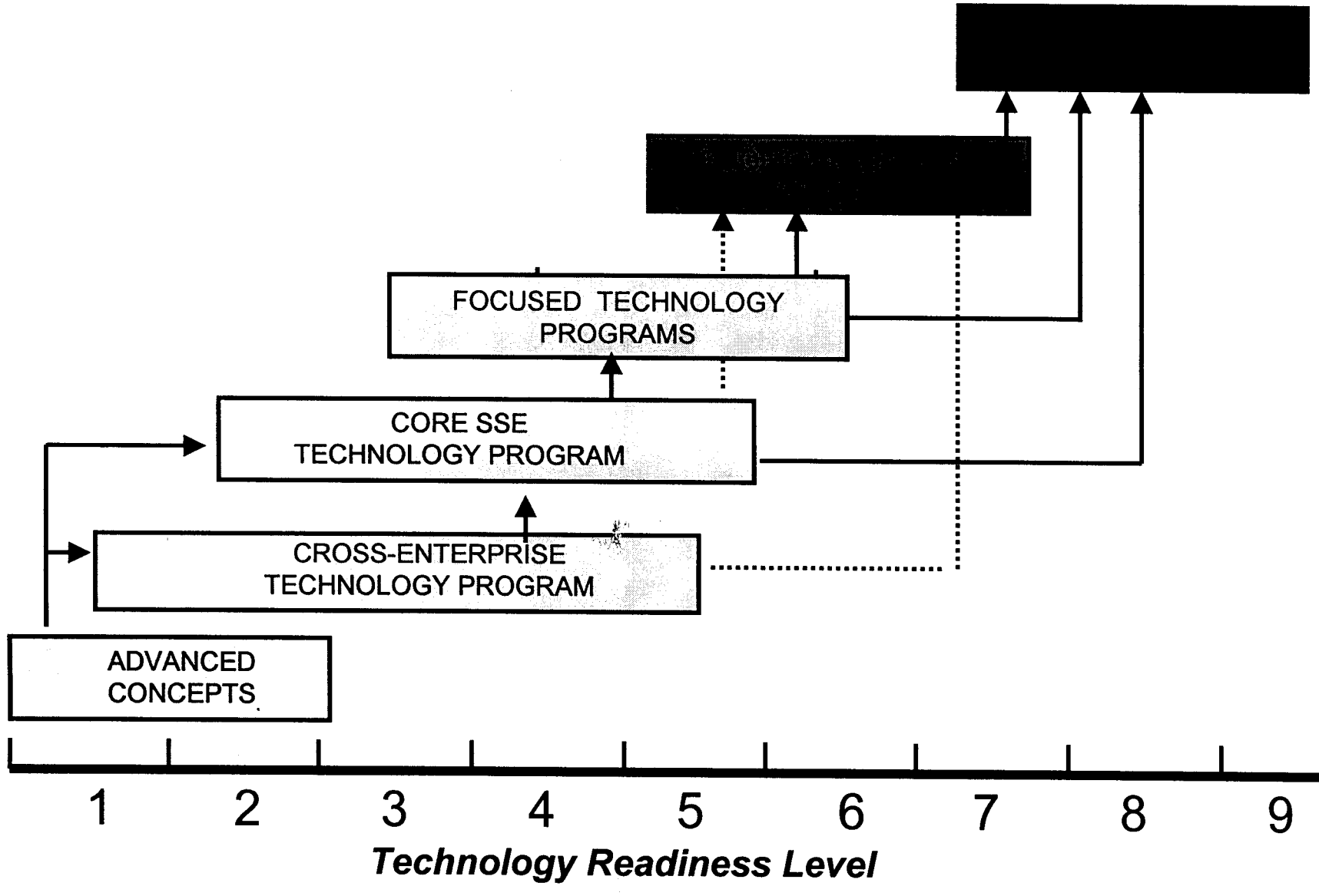
Primary Objectives:

1. Identify and select technologies for flight validation which optimize the benefits to the Space and Earth Science programs
2. Develop and implement effective validation missions as appropriate testbeds for the selected breakthrough technologies; and
3. Proactively disseminate the technology validation results to facilitate the timely infusion into future science missions.

Secondary Objectives:

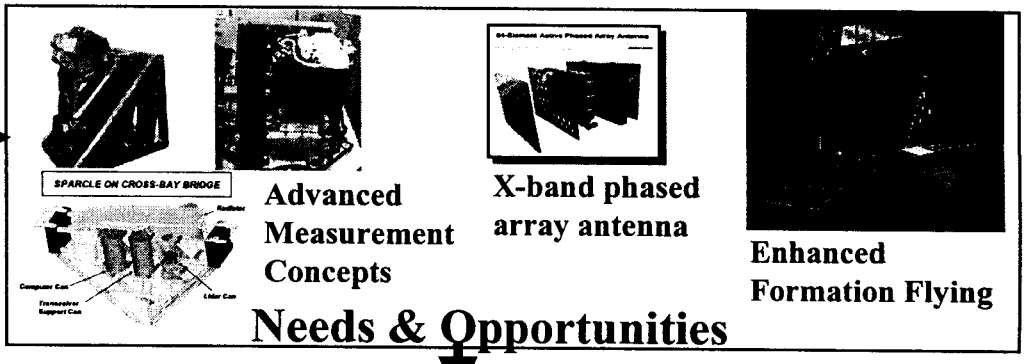
1. Return high priority science data to the extent possible within cost and mission constraints
2. Establish interagency and industry-government partnerships in the development of these technologies for NMP flights.
3. Infuse the validated technologies into the government partners' missions and into the general national industrial base.

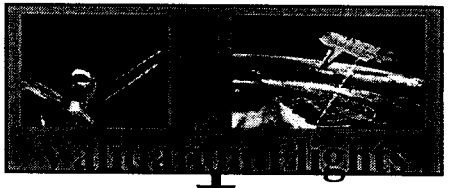
Technology Program Elements

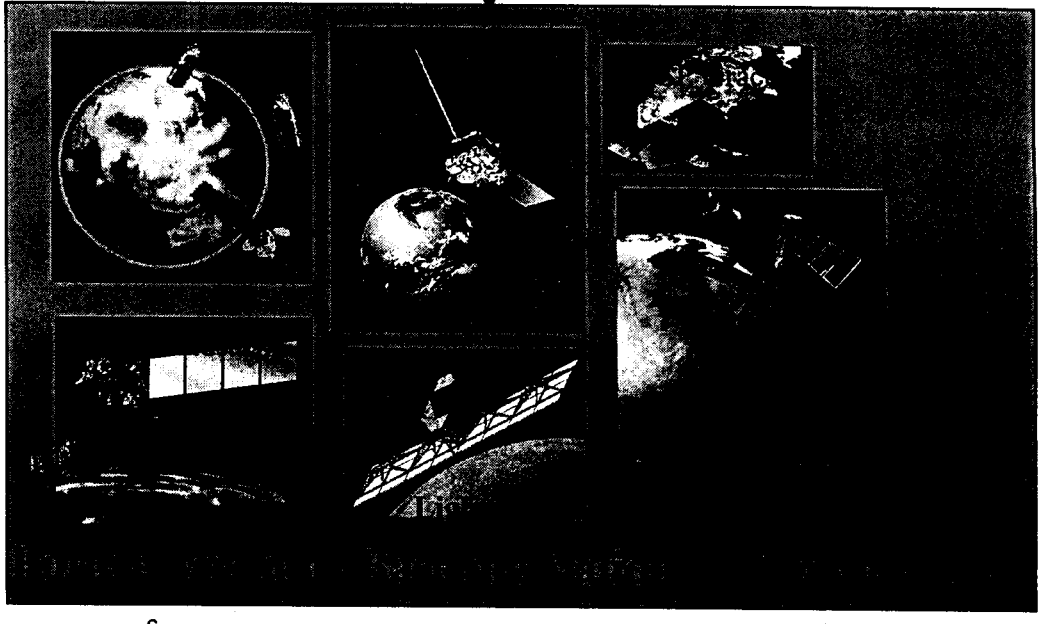


Validation Flight Definition, Selection, and Implementation Processes

- Identification of Needs
- Identification of Tech.
- Project Formulation
- Technology Selection
- Project Implementation & Tech Validation
- Technology Infusion

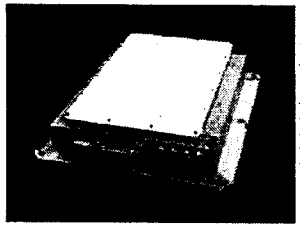




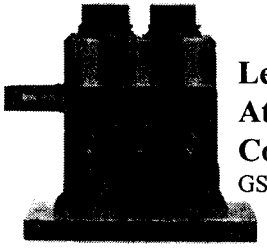


Earth Observer 1

Validation of 9 Breakthrough Technologies

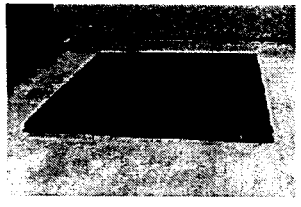


X-Band Phased Array Antenna:
Boeing, GSFC & Lewis Research Center

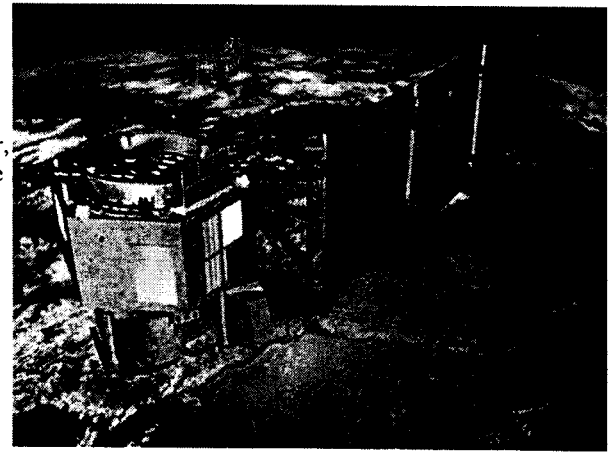


Leisa Atmospheric Corrector:
GSFC

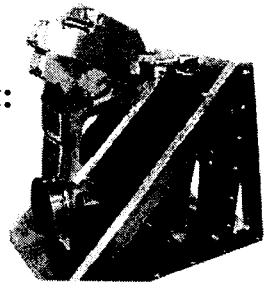
Advanced Land Imager:
MIT Lincoln Lab, GSFC, Raytheon / Santa Barbara Remote Sensing, & Sensor Systems Group



Carbon-Carbon Radiator:
Air Force Research Lab, Amoco Polymers, BF Goodrich, GSFC, Langley Research Center, Lockheed Martin, Naval Surface Warfare Center, & TRW

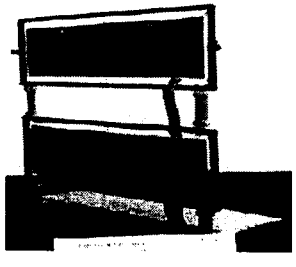


Spacecraft:
GSFC, Litton, SWALES

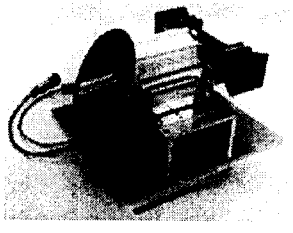


Hyperion:
GSFC, & TRW

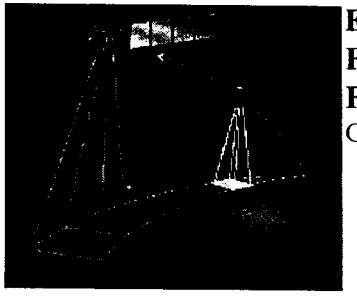
Wideband Advanced Recorder Processor:
GSFC, Litton, MIT Lincoln Lab, Swales, & TRW



Lightweight Flexible Solar Array:
GSFC, Lockheed Martin, & Phillips Lab



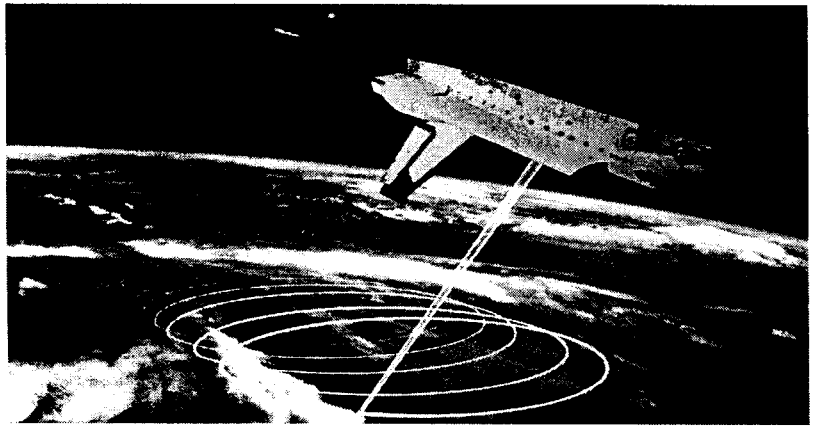
Pulsed Plasma Thruster:
GSFC, Lewis Research Center & PRIMEX



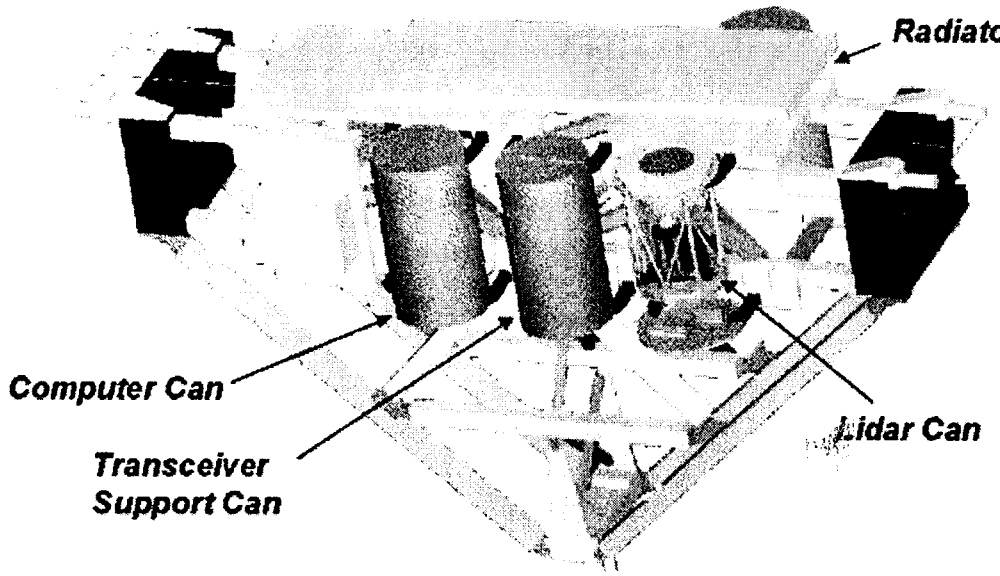
Enhanced Formation Flying
GSFC, JPL

Earth Observer 2

SPAce Readiness Coherent Lidar Experiment (SPARCLE)

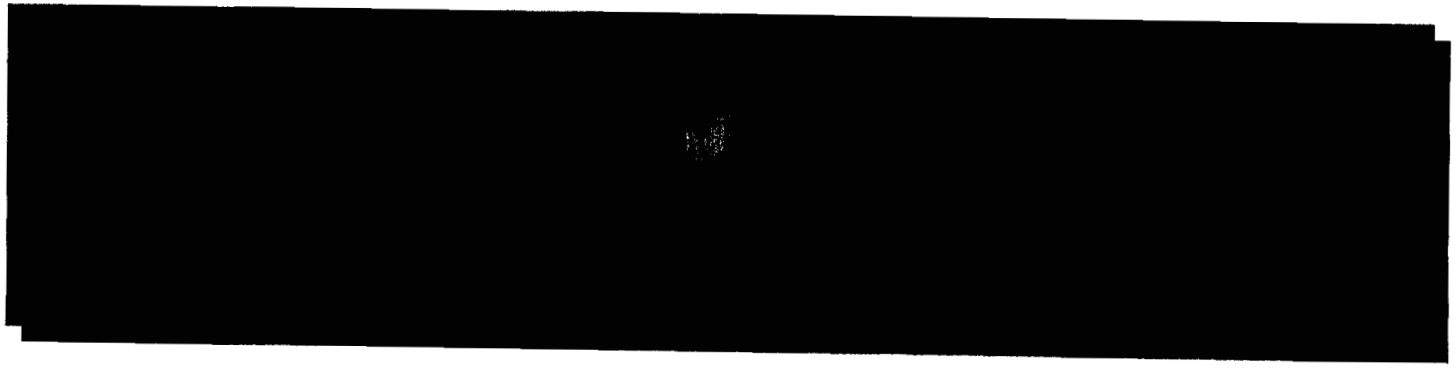


SPARCLE ON CROSS-BAY BRIDGE



Lidar (laser radar) method to measure winds from space.

- Pulsed, Eyesafe, Coherent Detection Doppler Wind Lidar
- 100 mJ, 6 Hz., 0.25 m, 30 degree from nadir; 300 km, 51 degrees or greater orbit
- MSFC/LaRC/JPL/GSFC/UAH/CTI/SWA Collaboration
- Shuttle Technology Demonstration
- Mission: 3 Hitchhiker Cans
- Full Lidar Technology & Scanning
- Science Products: LOS & Vector winds,
- Cloud Heights & Properties, and Aerosol Backscatter Distribution

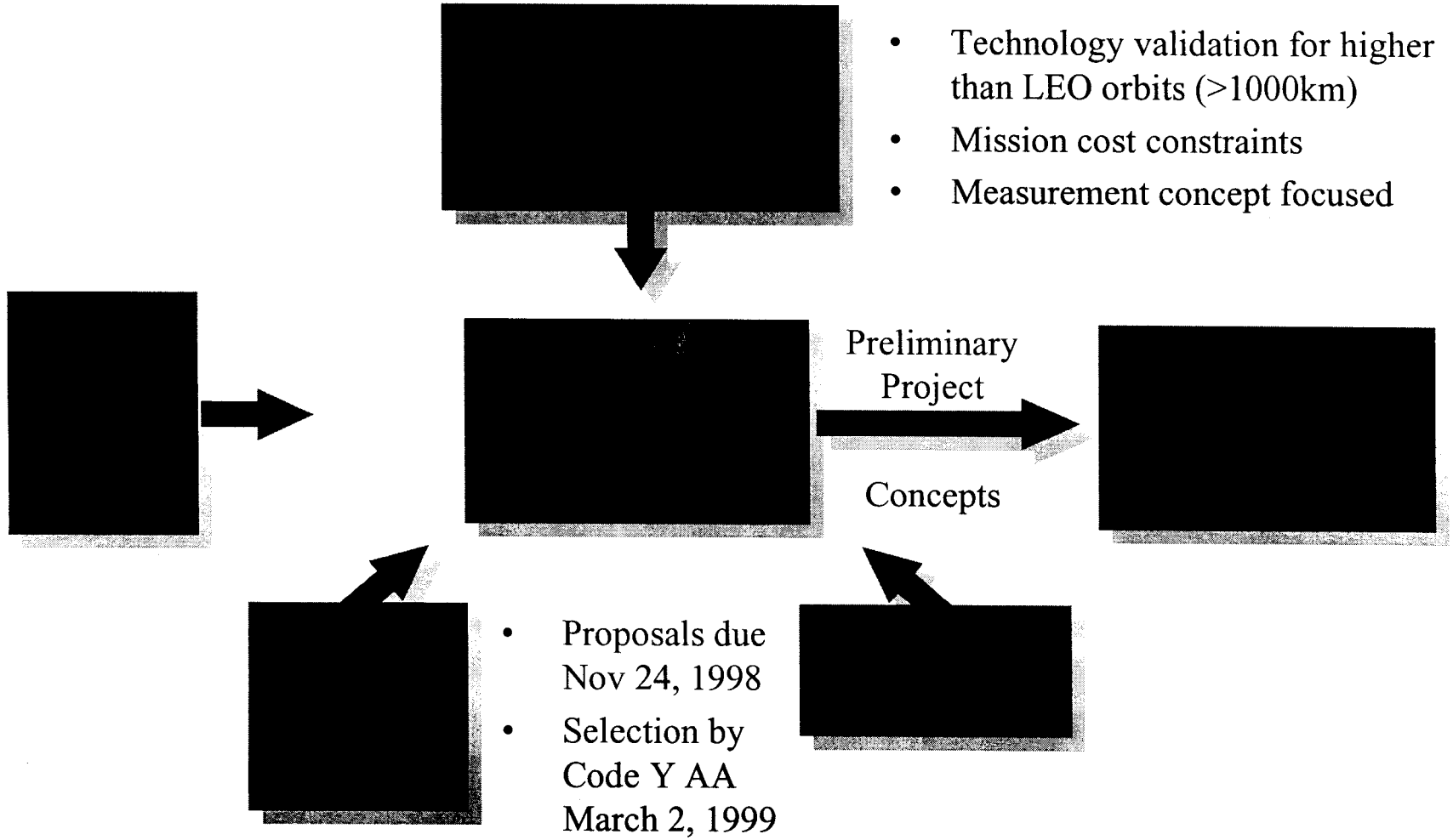


Project Formulation and Technology Selection Process

- The NMP Project Formulation Process is initiated by forming an Integrated Project Formulation Team (IPFT)
  - Advanced *Measurement Concepts* solicited through an open competitive call (NRA)
  - The technologies needed to implement these concepts are chosen through a separate open call
- The project formulation process has two distinct phases:
  - Project concept definition phase (Phase A)
    - Study teams led by NMP
    - Open call for technology providers
  - Project formulation refinement phase (Phase B)
    - Project team led by implementing organization
    - Detailed project design and project plan completed
    - Major industry partners selected
- Selection review / confirmation review and decision by Enterprise Associate Administrator

EO3 Project Formulation:

Concept Definition Phase



- Technology validation for higher than LEO orbits (>1000km)
- Mission cost constraints
- Measurement concept focused

- Proposals due Nov 24, 1998
- Selection by Code Y AA March 2, 1999

The EO3 Opportunity

The NASA Office of Earth Science (OES) directed the NMP to:

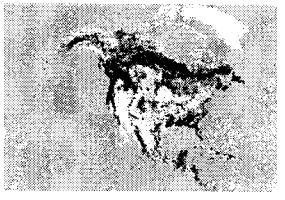
- Focus the third Earth Observing mission, EO3, on innovative measurement concepts for remote sensing observations from orbits beyond conventional low-Earth orbit (LEO)
  - Geostationary orbits
  - Highly elliptical orbits
  - Mid-Earth and high-Earth orbits
  - L1 and L2
- Issue an NASA Research Announcement (NRA) to solicit the measurement concepts
  - Maximize participation by the Earth science and technology communities
  - identify revolutionary technologies, and/or measurement strategies
- 24 proposals were submitted and peer reviewed by the OES
- 4 concepts were selected for further study

EO3 Measurement Concepts

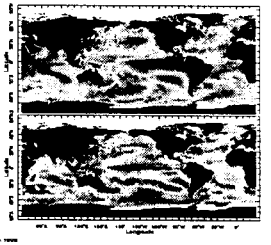
Four Measurement Concepts were chosen for further study as candidates for EO-3 mission

Active Large Aperture Optical Systems for High Resolution Thermal Imaging from Geostationary Orbit
Del Jenstrom, GSFC

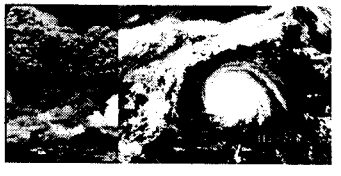
Geostationary Imaging Fourier Transform Spectrometer
Dr. William L. Smith, LaRC



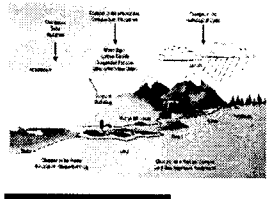
Land-Cover and Land-Use Change



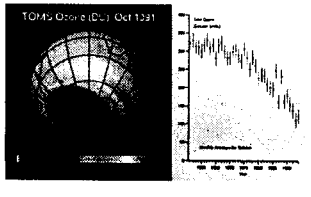
Seasonal-to-Interannual Climate Variability and Prediction



Natural Hazards Research and Applications

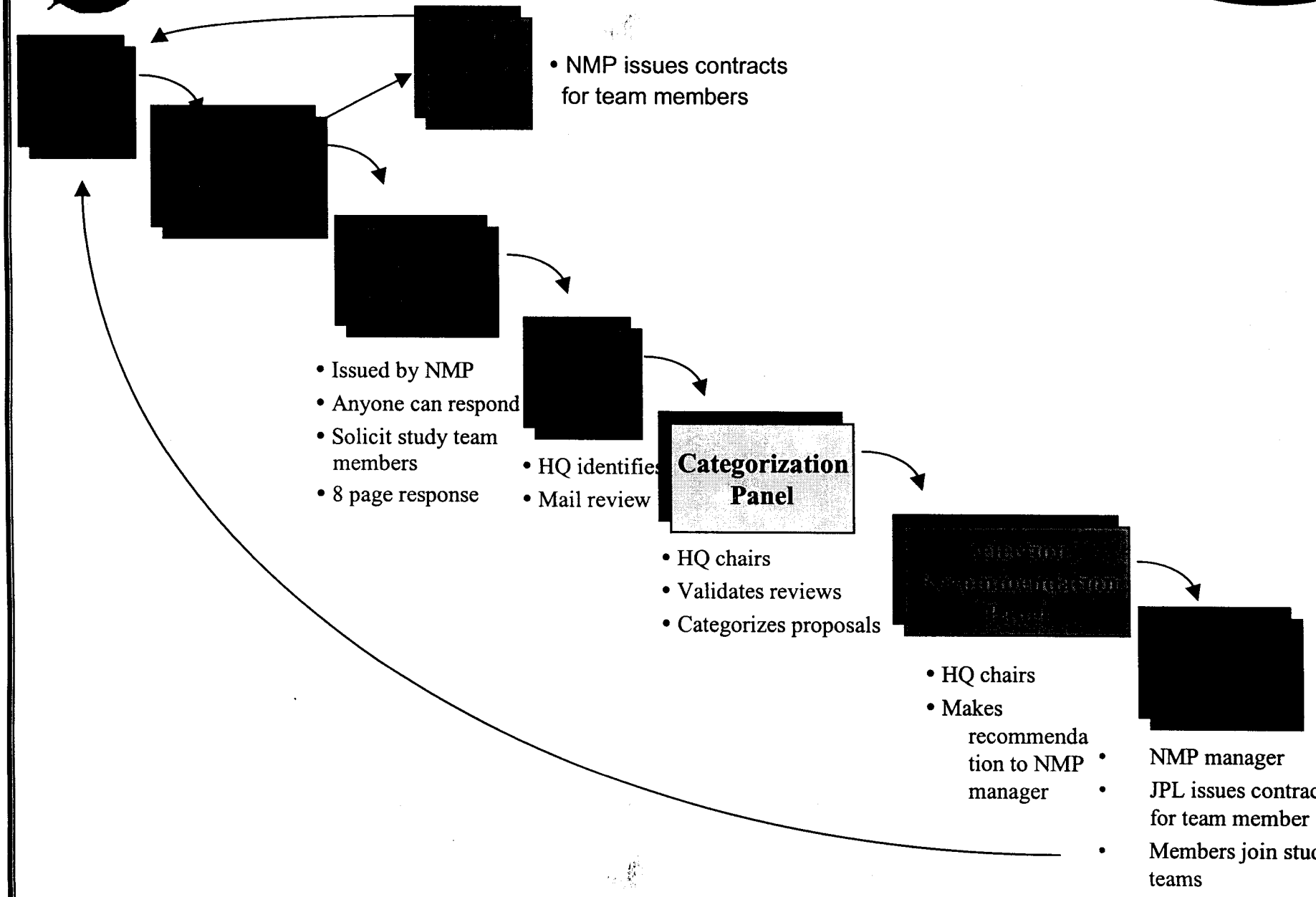


Long-Term Climate: Natural Variability and Change Research



Atmospheric Ozone Research

EO3 Technology Solicitation



Integrated Project Formulation Team (IPFT)

Purpose:

To design NMP validation flights that fully validate the selected measurement concept and its required technologies and ensures their infusion into future missions

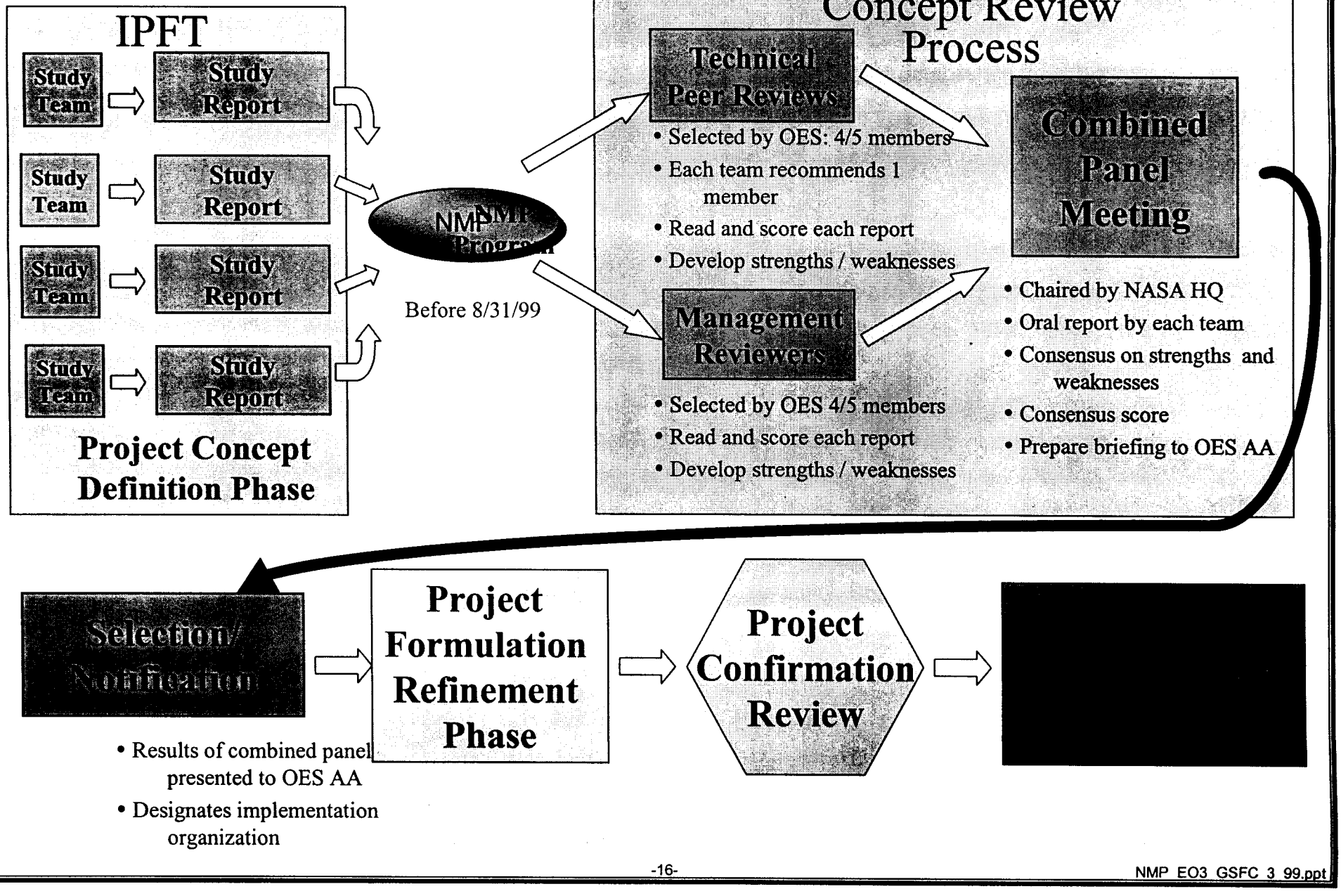
Responsibilities:

- Design candidate missions during concept formulation phase
- Refine selected validation flights leading to confirmation
- Transition to Project Implementation Team as appropriate

Membership:

- NMP Staff Members including scientists, technologists and systems engineers
- Ad hoc members from the science and technology communities*
- **Selected measurement concept providers selected through NRA**
- **Technology providers selected through open call**
- *Appointed by Program Manager/Concurred by SESP Director and HQ

EO3 Mission Selection Process



Technology Validation and Infusion